1
SECOND UNIT BODY

SECOND UNIT BODY MOUNTING INDEX

2019
MODEL YEAR

SECOND UNIT BODY MOUNTING	Page
General Information	2
E-Series Cutaway	3
E-Series Stripped Chassis	4
Super Duty F-Series	5-7
Transit	8-10

SECOND UNIT BODY MOUNTING GENERAL INFORMATION

INFORMATION

The following recommendations are intended to assist in the design of second unit bodies and body mounting systems that will control second unit body movement with respect to the Ford supplied chassis when tested to the procedures specified in F/CMVSS 126, 204(1), 208, 212(2), 214(2), 219(2), and 301(2). These recommendations are based on testing and analyses performed by Ford Motor Company.

Second Unit Bodies (SUB) and their body mounting systems may take many forms, and the following recommendations cannot cover all the possibilities. Strict adherence to these recommendations will not ensure that the completed vehicle will comply with F/CMVSS 126, 204(1), 208, 212(2), 214(2), 219(2), or 301(2). The final stage manufacturer who installs a second unit body on the chassis is responsible for compliance to the above mentioned regulations. Accordingly, Ford Motor Company cannot represent that these recommendations are appropriate for every specific application of a second unit body, the body mounting system, or act of a subsequent stage manufacturer.

To verify compliance of a particular second unit body and selected body mounting system with F/CMVSS 204(1), 208(2), 212(3), 214(3)(4), 219(3), and 301(3), the testing of a representative vehicle to the applicable procedures of the above regulations is recommended. Questions regarding compliance with F/CMVSS regulations should be directed to your legal counsel, the National Highway Traffic Safety Administration, or Transport Canada.

SECOND UNIT BODY STRUCTURES

The structural design and materials used in the construction of second unit bodies must be sufficient to help control collapse of the body and prevent disengagement from the chassis when tested in accordance with the specifications of F/CMVSS 126, 204(1), 208, 212(2), 214(2), 219(2), and 301(2). Steel or aluminum structures are recommended, however, wood or composite materials may require additional reinforcements to provide the structural integrity required for actual crash testing. SUB structures should not exceed beyond (overhang) the end of the chassis (frame side members).

SECOND UNIT BODY FUEL SYSTEM COMPONENTS

SUB floor and bulkhead structures must accommodate the Ford fuel fill system and suggested design clearances. Fill neck locations and all F/CMVSS 301(2) compliance representations for Super Duty F-Series and E-Series vehicles are in the Statements of Conformity section of the Incomplete Vehicle Manual. See additional Fuel System Design Recommendations.

SECOND UNIT BODY ELECTRICAL

Some electrical power sources are identified in the Design Recommendations and the F/CMVSS 108 compliance representations in the Incomplete Vehicle Manual. For wiring diagrams and additional information see Electrical Wiring pages in the Electrical Section.

HEADLIGHT ALIGNMENT

Headlight initial aim is set at the assembly plant, but may not be correct for your final vehicle configuration. Therefore, headlight aim verification after installation of the SUB is the responsibility of the final stage manufacturer, and should be part of the completed vehicle sign-off.

UNDERBODY HEAT MANAGEMENT

1. Underbody longitudinal or lateral air movement should not be restricted. Frame spacers designed by the intermediate and final stage manufacturer should provide for adequate airflow over the frame.
2. No portion of the floor pan should drop below the body sills, nor should the underbody structure drop below the top surfaces of the number 3 and 4 crossmembers. These conditions can result in reduced airflow, pinched fuel lines or vapor hoses which can raise the temperature of underbody components and increase fuel system pressure.
3. Any interior floor underlayment or insulation in the near vicinity of the exhaust system, without benefit of the Ford provided heat shields, must be capable of withstanding 371°C [700°F] (482°C [700°F] in close proximity to the catalyst) during normal operating conditions. Additionally, any underchassis-mounted components within 101.6 mm [4 in] of the exhaust system must be compatible with these temperatures.
4. Second unit body exterior panels, tool boxes, running boards, structures, or skirting that extend below the bottom of the frame, may affect underbody temperatures. The final stage manufacturer should verify that underbody temperatures of the completed vehicle are compatible with all vehicle's components when under conditions that consider the projected vehicle duty cycle and vehicle loading.
5. Full-width mudflaps should not be installed, as they restrict airflow under the vehicle and can also increase underbody temperatures.
6. Added structure or equipment should not restrict air circulation in the engine compartment/underbody.
7. Added body vents, especially powered vents, should be located away from the fuel filler and venting areas and exhaust to avoid fuel fumes and vapors entering the interior of the vehicle.
8. Use of wood in construction should be eliminated where at all possible. If used, wood should be adequately protected from moisture and heat. Shields should be added if wood is installed near exhaust components.

The subsequent stage manufacturer should also consider the following situations, which may have an adverse effect on heat management.

- Poor vehicle service or lack of maintenance
- Deviation from a Ford recommended antifreeze coolant
- Exceeding Ford GVW and GCW ratings
- Malfunctioning systems such as exhaust or engine
- Altering, changing, removing Ford engine cooling fan and shroud
- Blocked radiator grille area (spare tire, bicycles, etc.)
- Use of throttle kickers
- Addition of aftermarket PTO system

NOTES —

(1) For vehicles with a GVWR of 10,000 lb or less and an unloaded vehicle weight of 5500 lb or less.

(2) Applicable to vehicles with a GVWR of 10,000 lb or less.

SECOND UNIT BODY MOUNTING
E-SERIES CUTAWAY

E-SERIES SUPER DUTY CUTAWAY SUB MOUNTING SYSTEM

FORD OPTIONAL SPACERS

Ford provides optional SUB mounting spacers which will isolate the SUB from the frame. The SUB should be attached to these spacers using all the provided holes in the spacer with a suggested minimum 7/16-14 UNC grade 8 fastener. These fasteners should be directed away from any fuel system component or should not extend more than 25.4 mm [1.00 in] below the spacer flange. The rubber isolators on the spacers are capable of 19.0 mm [0.75 in] movement from a static (design) position, which is the same for the isolators that mount the cutaway body to frame. This will minimize squeaks, rattles and water or air leaks at the mounting surface of the SUB, to the cutaway body. The Ford optional spacers will accommodate the recommended fuel fill neck installation and a recommended 101.6 mm [4.00 in] minimum clearance between the frame and the bottom of the SUB (except at the rear axle kick-up area).

NON-FORD SPACERS

Vehicles not equipped with the Ford optional spacers have 34.8 mm [1.37 in] diameter holes on the upper flange of the frame sidemembers for body to frame isolators. The density/durometer, size and quantity of these isolators should be based on the SUB weight plus the projected payload of the completed vehicle, within the limits of the GAWRs and GVWR, as determined by the final stage manufacturer.

NO SPACERS

If the final stage manufacturer chooses to attach the SUB (or other components) to the frame by bolting or welding, the following restrictions are to be followed:

1. The frame rail flanges, including the flange bend radius, must not be drilled or welded upon. Also, flanges may not be cut/trimmed to provide clearance to added hardware or structure.
2. When bolting the SUB (or other components) to the frame, follow the guidelines in the Pickup Box Delete section.

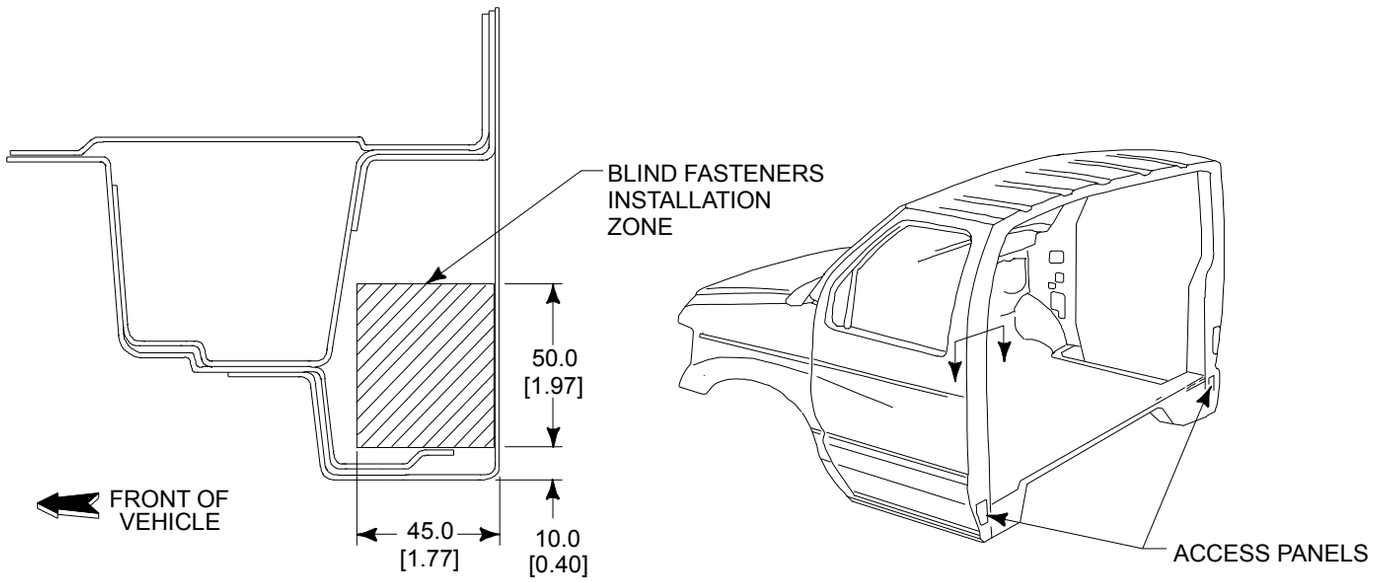
Note that hard mounting of the SUB to the frame and to the cutaway body may result in NVH and cutaway body durability issues.

NOTES

4470 mm [176 in] wheelbase vehicles equipped with a 55 gallon fuel tank will require a 457 mm [18.00 in] minimum frame extension to provide for an adequate departure angle.

The attachment of the SUB to the cutaway body should consider the following:

1. Blind installation of self-expanding nut type fasteners can be located in the zone as defined in the figure on this page, and should allow for functional expansion, and be equally spaced. The body edge flange may also be used for fasteners provided the center of the required hole is 1.5 times the hole diameter from the edge of the panel. These recommendations apply to both B-pillar attachment.
2. Removal of the access panel and fasteners at the lower area of the B-pillar will allow for flush mounting of the SUB. This opening should be completely covered and sealed from obvious climatic conditions.
3. Roof attachments should be equally spaced and are permitted on the flange provided. The center of the required holes should be 1.5 times the hole diameter from the edge of the flange.
4. Floor attachments should be equally spaced and are permitted on the flange provided. The center of the required holes should be 1.5 times the hole diameter from the edge of the panel.
5. Washers or doublers should be considered to increase the bearing surface under fasteners to increase joint integrity and to decrease sheet metal fatigue, squeaks, and rattles.
6. Gaskets or sealers installed between the cutaway body and the SUB should consider the displacement and stabilization of such materials when clamped, and the effect on joint integrity.



E-SERIES SUPER DUTY CUTAWAY BODY TO SECOND UNIT BODY ATTACHMENT

NOTE — [ ] DIMENSIONS ARE INCHES.

SECOND UNIT BODY MOUNTING
E-SERIES STRIPPED CHASSIS

E-350/450 SUPER DUTY STRIPPED CHASSIS SECOND UNIT BODY

A full length structural body should be attached to the chassis utilizing a system of body bolsters bolted and welded to the chassis frame sidemember as shown on this page.

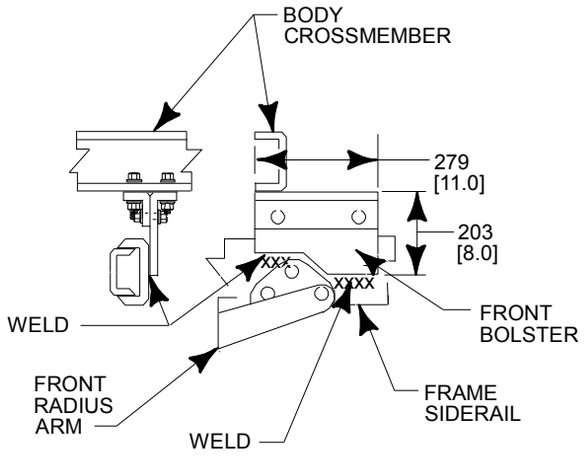
Rear body bolsters extend along the parallel sections of the frame sidemember using the existing 34.8 mm [1.4in] diameter holes as shown in View B, on this page.

Bolster attachment in the rear axle kick-up area can be accomplished by bolting shear plates to the web of the frame sidemember as shown in View C, on this page. The maximum size hole that may be drilled in the frame web is 19 mm [0.75 in] diameter. Refer to the drilling precautions in the Design section.

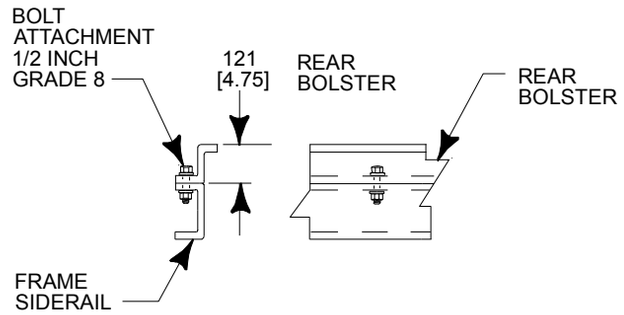
Front body bolsters should be attached to the frame sidemember as far forward as possible. They should be welded to the web of the frame sidemember immediately to the rear of the front radiator and cowl support structure as shown in View A. Front bolsters should not be bolted to the frame sidemember in this area since there is no access to the inside surface sidemember.

Each front bolster should be rigidly connected to the corresponding rear bolster through the body floor or a tie bar.

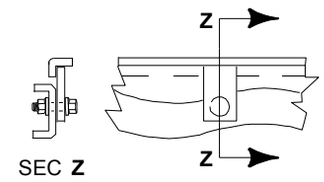
Do not weld to the flanges of the side rail. Refer to the welding precautions in the Design section.



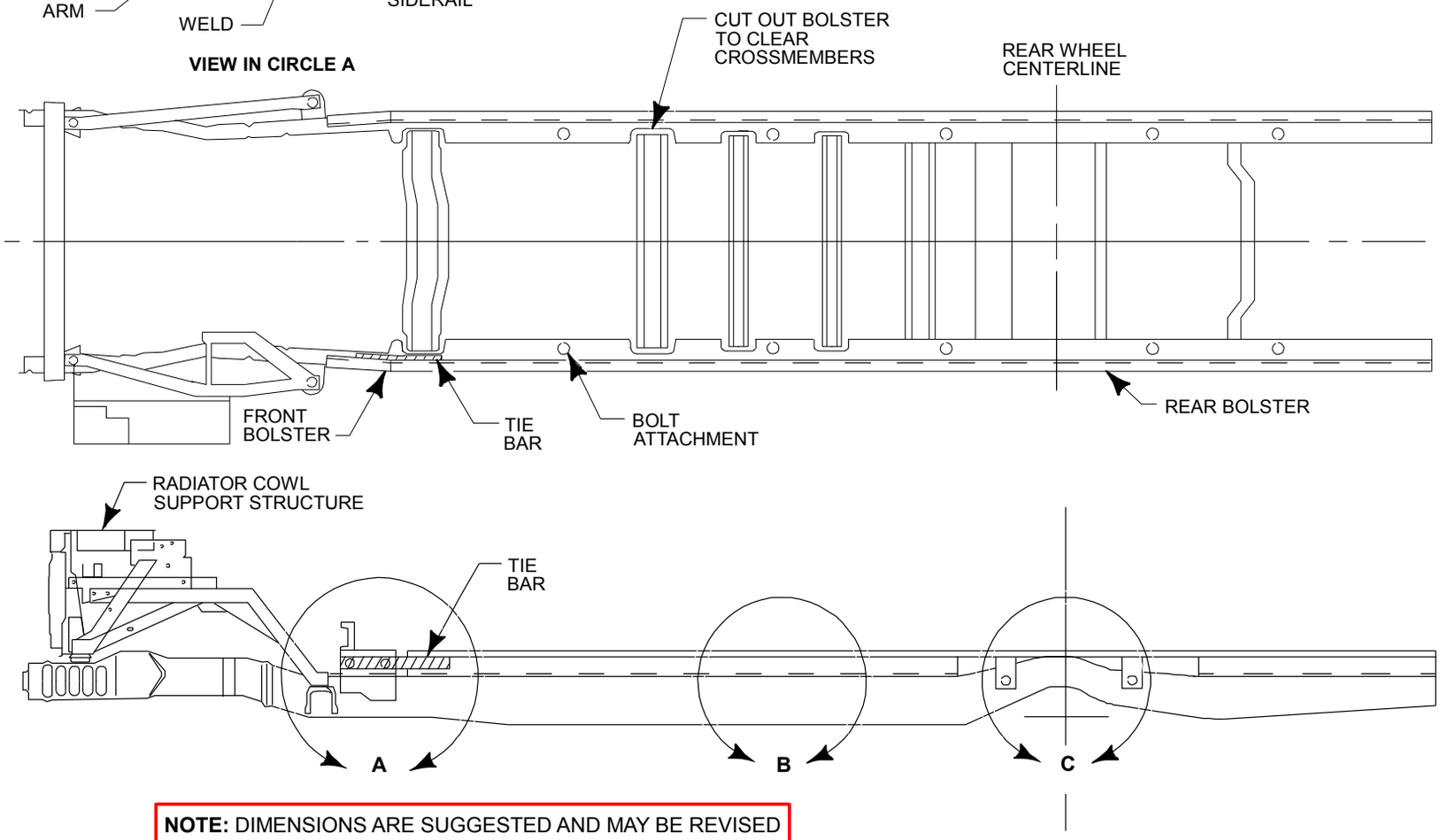
VIEW IN CIRCLE A



VIEW IN CIRCLE B



VIEW IN CIRCLE C



NOTE: DIMENSIONS ARE SUGGESTED AND MAY BE REVISED AT THE BODY BUILDER'S DISCRETION

E-350/450 SUPER DUTY STRIPPED CHASSIS SECOND UNIT BODY INSTALLATION

NOTE — [ ] DIMENSIONS ARE INCHES.

SECOND UNIT BODY MOUNTING
SUPER DUTY F-SERIES

SUPER DUTY F-SERIES SECOND UNIT BODY (SUB) MOUNTING TECHNIQUES FOR PICKUP BOX DELETE (WIDE FRAME)

The intent of the illustrations shown on the following two pages is to offer an expanded range of Second Unit Body (SUB) mounting design recommendations for Super Duty F-Series Pickup Box Delete trucks with a 1422 mm [56 in] Cab to Axle (CA) design.

SUB Mounting Techniques #1 and #2 for 56" CA with SUB weight 1800 kg (3960lb) or less:

These SUB mountings were tested by Ford Motor Company and found to be capable of complying with F/CMVSS requirements. The sketches in Figures A and B on the following page depict the recommended SUB mounting techniques.

SUB Mounting Technique #3 for 56" CA with SUB weight 1800 kg (3960lb) or less:

The third mount scheme is a top bolted mounting technique. This top bolted SUB mounting is recommended for the Super Duty F-Series pickup trucks with a 1422 mm [56 in] CA. This technique uses the existing pickup box mounting holes to mount a SUB weighing 1800 kg or less provided the SUB is mounted in a similar fashion to the Ford's pickup box. These mountings should use the same number of OEM fasteners and OEM locations. The sketch which is shown in Figure C depicts this technique. Refer to the Super Duty F-Series section for mounting hole layout.

SUB Mounting Technique #4 for 56" CA with SUB weight 1800 kg (3960lb) or less:

This technique embodies the Front and Rear Shear plate attachment as depicted in SUB Mounting Techniques #1 and #2, but requires addition of U-bolts for further attachment. Figures D and F depict this technique.

SUPER DUTY F-SERIES SECOND UNIT BODY (SUB) MOUNTING TECHNIQUES FOR CHASSIS CAB (NARROW FRAME)

Figures E and F show the SUB mounting design recommendations for Super Duty F-Series trucks with a 60", 84", 108", or 120" Cab to Axle (CA). Pre-punched holes are provided to accommodate front shear plates as shown in the Super Duty F-Series section.

DETAILS OF THE SECOND UNIT BODY MOUNTING TECHNIQUES

The following SUB mounting design recommendations are methods of attachment intended to minimize SUB movement under crash situations. The following items are important factors in the performance of the system:

1. The forward most surface of the SUB is located at least 76.2 mm [3.0 in] behind the rearmost surface of the cab. Refer to the Statements of Conformity for F/CMVSS 212(1), 219(1), and F/CMVSS 301(1) in the Incomplete Vehicle Manual.
2. Spacers between the frame and SUB must provide adequate clearance to the fuel fill system on wide frame pickup box delete models to allow a proper fuel filler pipe installation. Refer to the Statement of Conformity for F/CMVSS 301(1) of the Incomplete Vehicle Manual and the Design Recommendations for fuel fill systems.

SUB mounting instructions for a SUB weight of 1800 kg (3960lb) or less and a 56" CA:

- **Technique #1**

  Front shear plate attachment: use two 5/8" diameter grade 8 bolts, nuts, and washers in the OEM frame, one 5/8" diameter grade 8 bolt, nut and washers with a ¼" equivalent weld bead around three sides of the shear plate and the SUB mounting frame, skip-welded at the shear plate corners. See Figure A, View A. **DO NOT WELD THE SHEAR PLATES TO THE OEM FRAME.**

  Rear shear plate attachment: use three 5/8" diameter grade 8 bolts, nuts, and washers in the OEM frame, one 5/8" diameter grade 8 bolt, nut and washers with a ¼" equivalent weld bead around three sides of the shear plate and the SUB mounting frame, skip-welded at the shear plate corners. See Figure A, View B.

- **Technique #2**

  Front shear plate attachment: use two 5/8" diameter grade 8 bolts, nuts, and washers in the OEM frame, two 5/8" diameter grade 8 bolts, nuts and washers in the SUB mounting frame. See Figure B, View C.

  Rear shear plate attachment: use three 5/8" diameter grade 8 bolts, nuts, and washers in the OEM frame, two 5/8" diameter grade 8 bolts, nuts, and washers in the SUB mounting frame. See Figure B, View D.

- **Technique #3**

  Pickup box attachment: use eight 5/8" diameter, grade 8 flange nuts and bolts that utilize the existing pickup box holes in the top frame flanges. See Figure C.

SUB mounting instructions for a SUB weight over 1800 kg (3960lb) and a 56" CA:

- Use same as Technique #1 except with addition of U-bolts as shown in Figure D.

SUB mounting instructions for a SUB with a 60", 84", 108", or 120" CA:

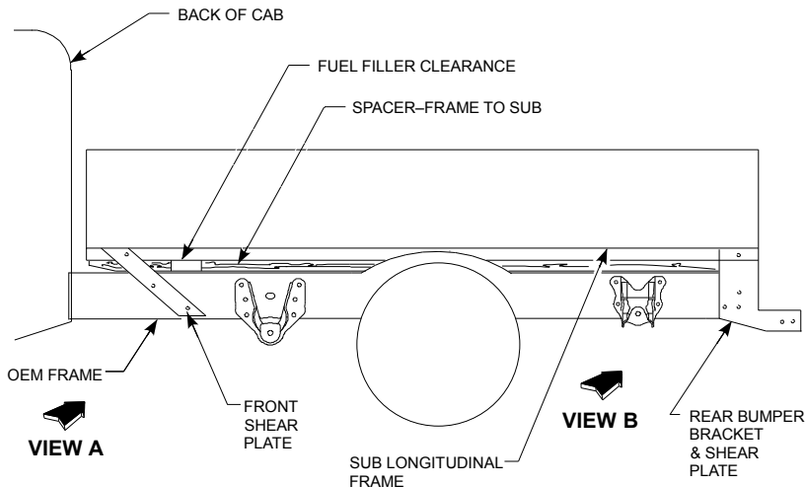
- It is recommended that the front shear plate mounting holes, as provided on each chassis, be used. Use the same front and rear shear plate attachment as Technique #1 or #2 with a 5/8" diameter U-bolt spaced every 24 to 36 inches. See Figure E.
- When U-bolts are used, vertical spacers must be between the upper and lower frame flanges at each U-bolt to prevent collapse of the flanges. See Figure F.

NOTE: The following items are important factors in the performance of the system:

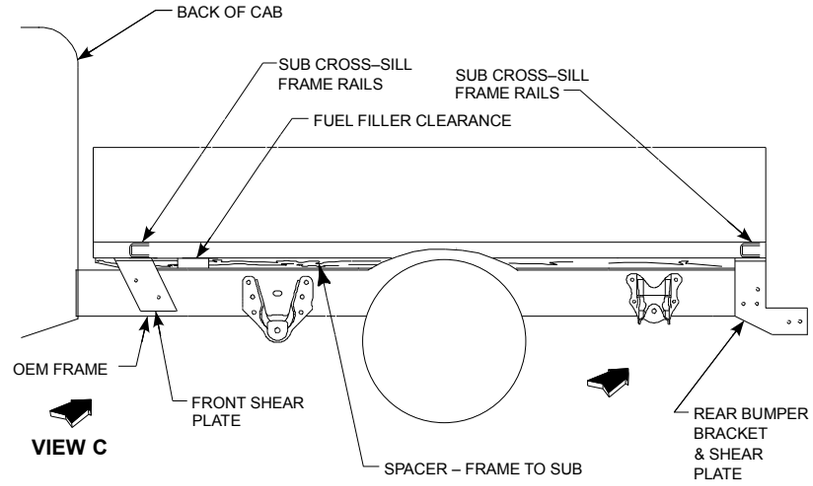
- The spacer should be secured in such a manner as to maintain retention during installation or during operational use and should have a slight taper which starts at the front of the SUB frame. See Figures D, E, and F.
- Front shear plates should be angled forward approximately 45 to 60 degrees from the horizontal. Front shear plates should be a sufficient distance from the front of the SUB to allow for frame flexing, i.e., front shear plates should be placed behind the tapered section of the spacer.
- Use 5/8" diameter, grade 8 bolts, nuts, and washers that attach the shear plates to the OEM vehicle and SUB frame.
- 60-65 ft-lb torque for the 5/8" diameter, grade 8 bolts, nuts, and washers.
- Direct the threaded end of the bolts away from any fuel, brake or electrical system components.
- U-bolts or attaching hardware should not contact fuel, brake or electrical system components. A shear plate should be utilized if there is insufficient space for a u-bolt to be installed between the frame and fuel tank.
- U-Bolt torque must be checked every six months.

(Cont'd next page)

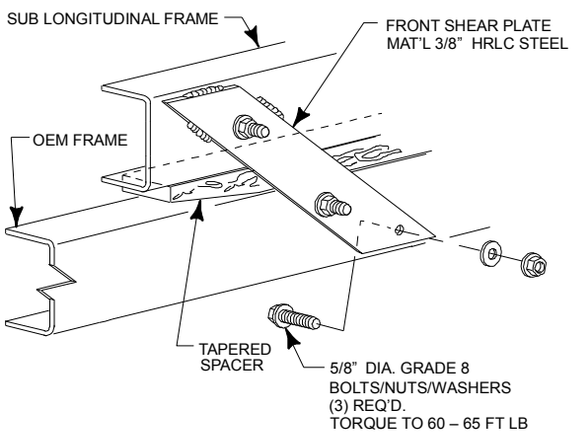
SECOND UNIT BODY MOUNTING
SUPER DUTY F-SERIES (Cont'd)



ATTACHMENT ARRANGEMENT WITH LONGITUDINAL SUB FRAME



ATTACHMENT ARRANGEMENT WITH CROSS-SILL SUB FRAME RAILS

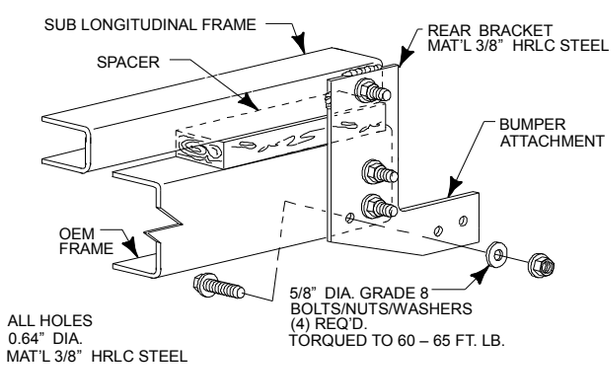

SUB LONGITUDINAL FRAME
FRONT SHEAR PLATE MAT'L 3/8" HRLC STEEL
OEM FRAME
TAPERED SPACER
5/8" DIA. GRADE 8 BOLTS/NUTS/WASHERS (3) REQ'D. TORQUE TO 60 – 65 FT LB

DRAWING DEPICTS SUB LONGITUDINAL FRAME WITH ONE 5/8" DIA. BOLT AND 1/4" WELD BEAD AROUND THE PERIMETER OF THE SHEAR PLATE.

IF THE SHEAR PLATE IS NOT WELDED ON THE SUB LONGITUDINAL FRAME, TWO 5/8" DIA. BOLTS WOULD BE NECESSARY TO ATTACH THE SHEAR PLATE TO THE LONGITUDINAL FRAME.

VIEW A

LEFT FRONT SHEAR PLATE
(SUB LONGITUDINAL FRAME)
RIGHT SHEAR PLATE IS A MIRROR IMAGE.


SUB LONGITUDINAL FRAME
SPACER
REAR BRACKET MAT'L 3/8" HRLC STEEL
BUMPER ATTACHMENT
OEM FRAME
ALL HOLES 0.64" DIA. MAT'L 3/8" HRLC STEEL
5/8" DIA. GRADE 8 BOLTS/NUTS/WASHERS (4) REQ'D. TORQUED TO 60 – 65 FT. LB.

DRAWING DEPICTS SUB LONGITUDINAL FRAME WITH ONE 5/8" DIA. BOLT AND 1/4" WELD BEAD AROUND THE PERIMETER OF THE SHEAR PLATE

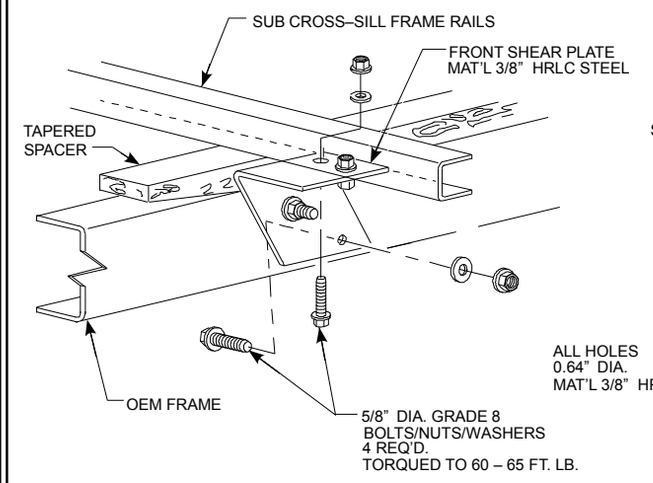
IF REAR BRACKET AND SUB FRAME ARE NOT WELDED TWO 5/8" DIA. GRADE 8 BOLTS WILL BE NECESSARY TO ATTACH REAR BRACKET TO SUB FRAME. THREE 5/8" DIA. BOLTS/NUTS/WASHERS ARE NEEDED TO ATTACH THE REAR BRACKET TO OEM FRAME.

VIEW B

LEFT REAR BRACKET (SUB LONGITUDINAL FRAME)
RIGHT REAR BRACKET IS A MIRROR IMAGE.

RECOMMENDED SHEAR PLATE ATTACHMENT FOR SECOND UNIT BODIES WEIGHING 1800 KG OR LESS WITH A 56"CA

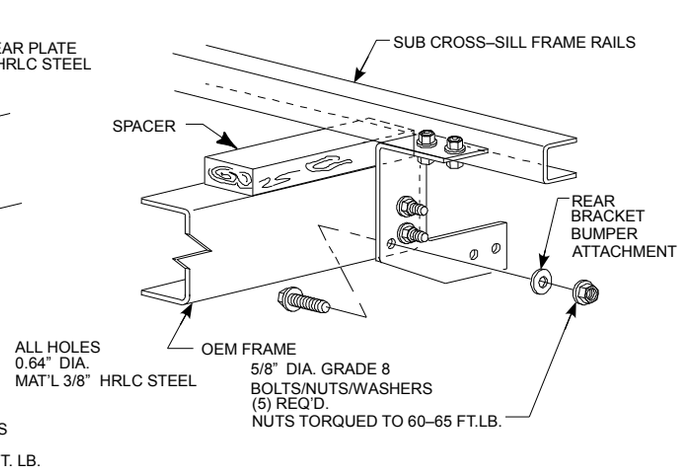
FIGURE A - SUPER DUTY F-SERIES SUB MOUNTING TECHNIQUE #1


SUB CROSS–SILL FRAME RAILS
FRONT SHEAR PLATE MAT'L 3/8" HRLC STEEL
TAPERED SPACER
OEM FRAME
5/8" DIA. GRADE 8 BOLTS/NUTS/WASHERS 4 REQ'D. TORQUED TO 60 – 65 FT. LB.

DRAWING DEPICTS SUB CROSS–SILL FRAME WITH TWO 5/8" DIA. BOLTS

VIEW C

LEFT FRONT SHEAR PLATE
(SUB CROSS–SILL FRAME)
RIGHT SHEAR PLATE IS A MIRROR IMAGE


SUB CROSS–SILL FRAME RAILS
SPACER
REAR BRACKET BUMPER ATTACHMENT
ALL HOLES 0.64" DIA. MAT'L 3/8" HRLC STEEL
OEM FRAME
5/8" DIA. GRADE 8 BOLTS/NUTS/WASHERS (5) REQ'D. NUTS TORQUED TO 60–65 FT.LB.

DRAWING DEPICTS SUB CROSS–SILL FRAME WITH TWO 5/8" DIA. BOLTS ATTACHING THE REAR BRACKET TO SUBFRAME, THREE 5/8" DIA. GRADE 8 BOLTS/ NUTS/WASHERS/ARE NEEDED TO ATTACH THE REAR BRACKET TO THE OEM FRAME BOLTS ATTACHING THE REAR BRACKET

VIEW D

LEFT REAR BRACKET (SUB CROSS–SILL FRAME)
RIGHT REAR BRACKET IS A MIRROR IMAGE.

RECOMMENDED SHEAR PLATE ATTACHMENT FOR SECOND UNIT BODIES WEIGHING 1800 KG OR LESS WITH A 56"CA

FIGURE B - SUPER DUTY F-SERIES SUB MOUNTING TECHNIQUE #2

(Cont'd next page)

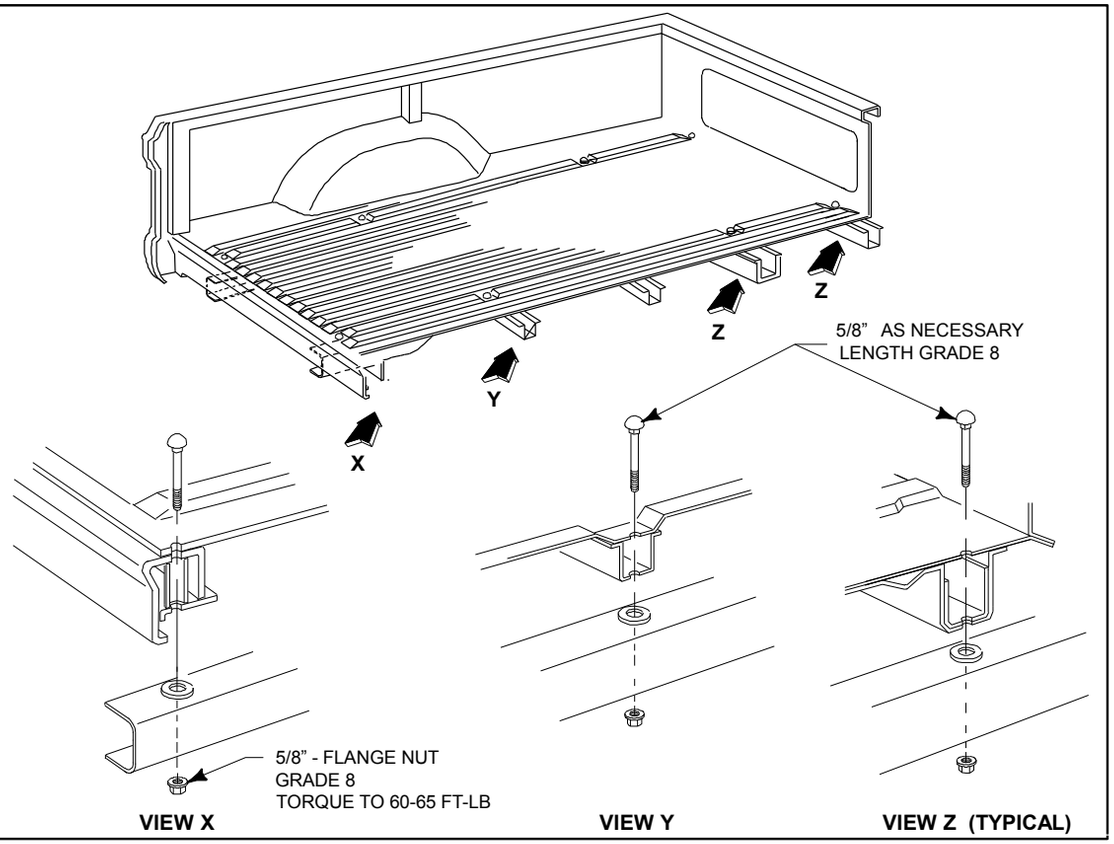


FIGURE C - SUPER DUTY F-SERIES SUB MOUNTING TECHNIQUE #3

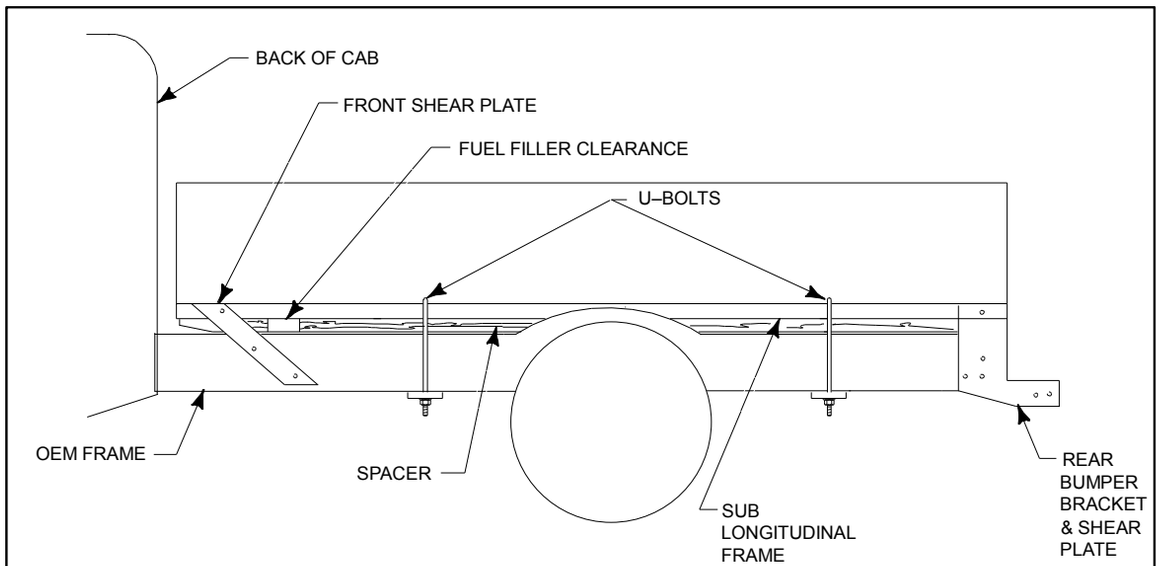
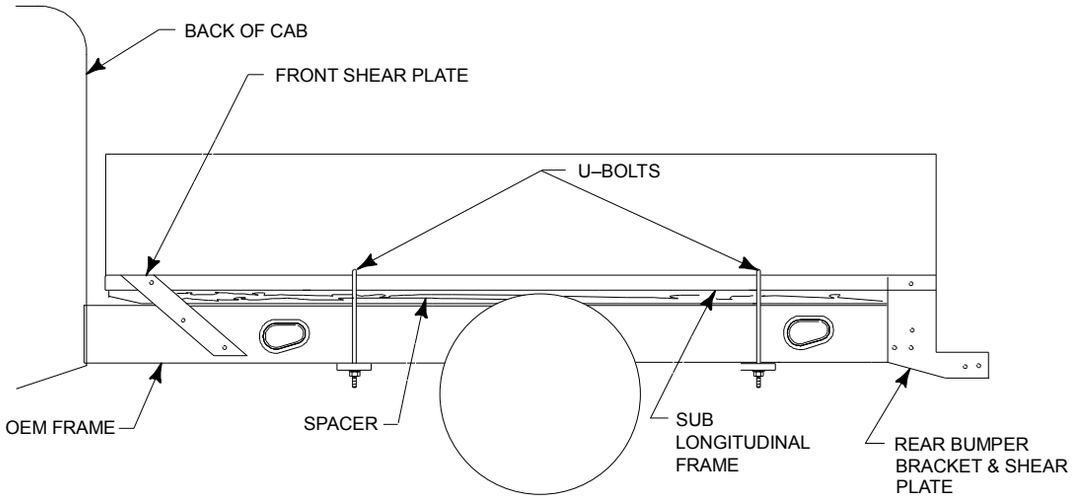
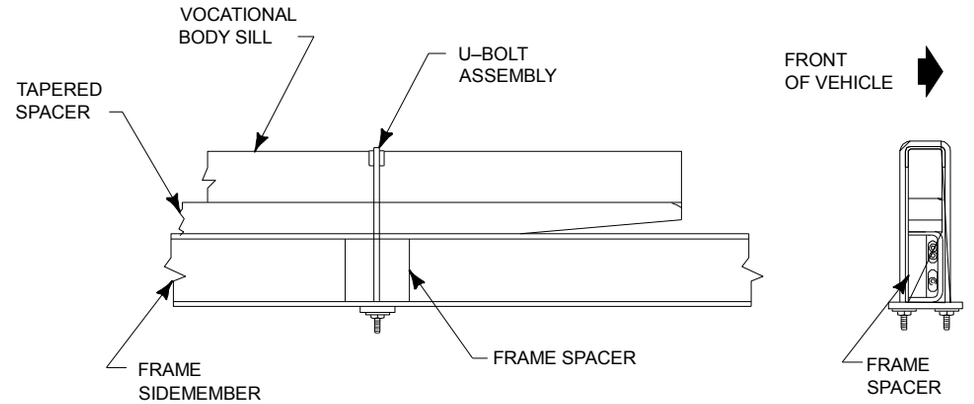


FIGURE D - SUPER DUTY F-SERIES SUB MOUNTING TECHNIQUE #4



Same front and rear shear plate attachment as SUB mounting techniques #1 and #2 with a U-Bolt spaced every 24 to 36 inches. Torque 5/8" U-bolts to 60-65 ft-lb. Do not notch the frame flanges to make the U-bolts fit. Place a spacer in between the OEM frame flanges to provide proper U-bolt torque.

FIGURE E - SUPER DUTY F-SERIES SUB MOUNTING FOR 60", 84", AND 120" CA CHASSIS CABS



TYPICAL INSTALLATION
(VIEW SHOWING INBOARD SIDE OF RAIL)

Where wrap around body attachments (such as U-Bolts) are used, the frame sidemembers must have flange reinforcement spacers to avoid flange damage when full torque is applied to attaching bolts. Spacers are recommended and must be cut out to clear brake lines, fuel lines, wiring, etc. If metal spacers are used, no welding to frame sidemembers is permitted.

Tapered spacers between vocational-body sill and frame sidemember flanges are recommended. (see sketch for typical installations).

Periodic checking of body attachments for torque retention is highly recommended.

A minimum of one set of shear plates per side is recommended. Also, one set of side shift plates should be attached to vocational-body sills per side.

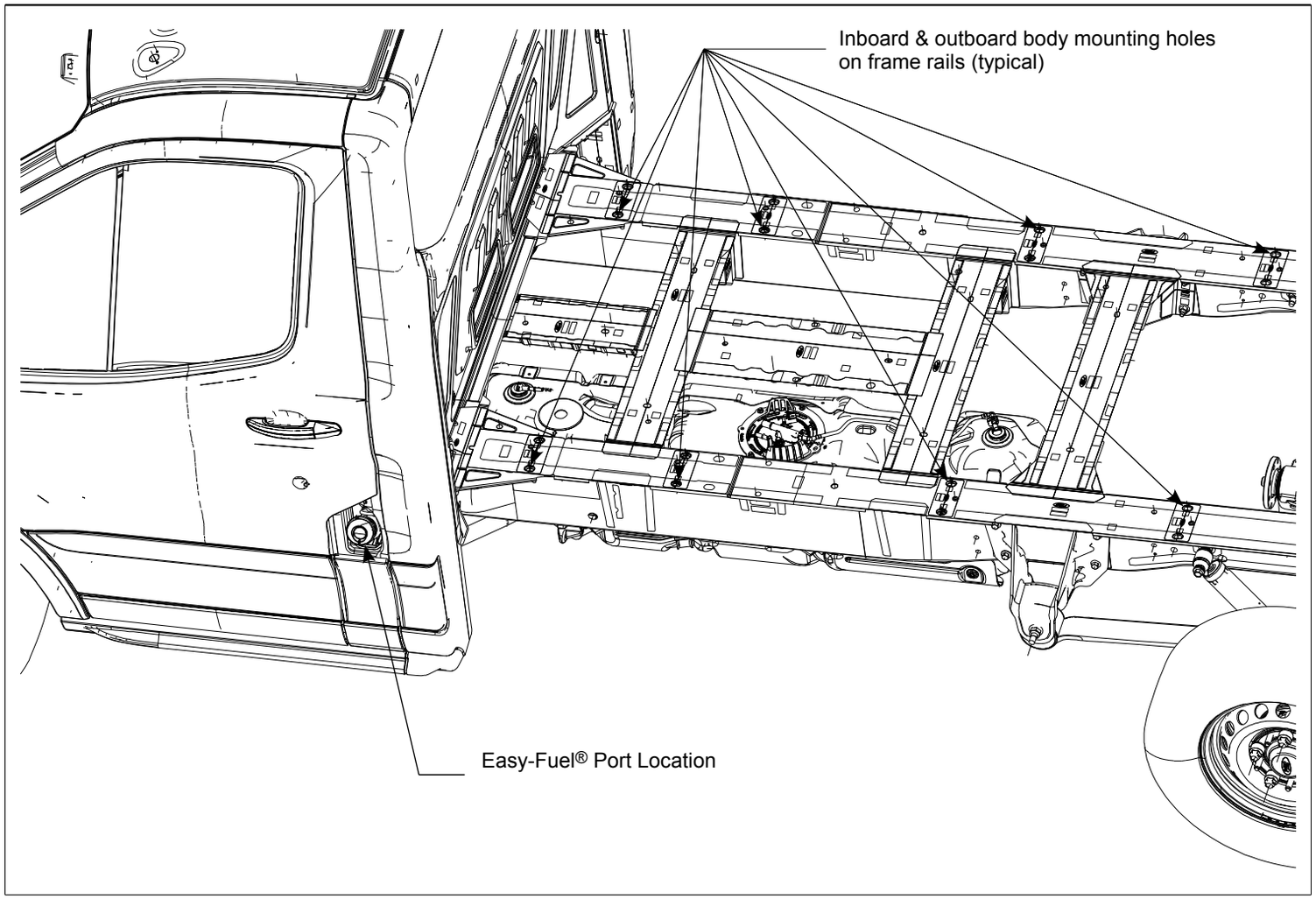
FIGURE F - SUPER DUTY F-SERIES SUB FRAME SPACER FOR U-BOLT

SECOND UNIT BODY MOUNTING
TRANSIT

TRANSIT SECOND UNIT BODY

Refer to the Transit Incomplete Vehicle Manual (IVM) and the *Transit Body and Equipment Mounting Manual (BEMM)*, Body Section, 5.1.6 Chassis Cab / Cutaway at https://fordbbas.com for additional SUB mounting information.

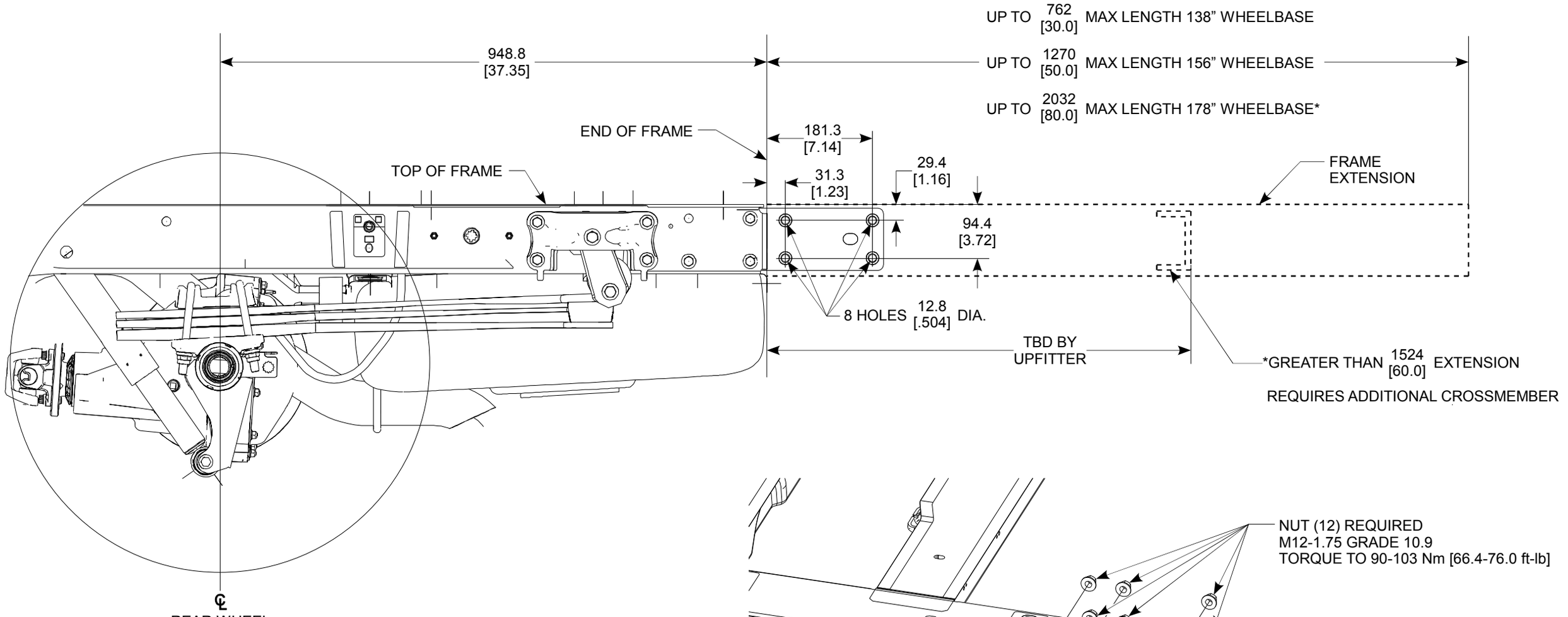
- A full length structural body should be hard-mounted to all available inboard and outboard frame hole locations, however, **fasteners are not required in the 2nd and 3rd rows of LH and RH frame rail inboard holes alongside the fuel tank and exhaust muffler**. Ford Motor company recommends 25mm head-size flange M10 Grade 10.9 W520113-S442 nuts & W703776-S442 bolts, or equivalent. Ref: BEMM Body Section, 5.1.6 Chassis Cab / Cutaway.
- Do not weld to the flanges of the side rails.
- The recommended attachment fastener for the Cutaway Back-of-Cab non-threaded nutplates is a MR8 Taptite 2000® bolt or equivalent. Ref: BEMM Body Section, 5.1.7 Cutaways.
- Note the requirement for a Cutaway floor spacer between the cab and an attached body. Ref: BEMM Body Section, 5.1.7 Cutaway – Floor Spacer.

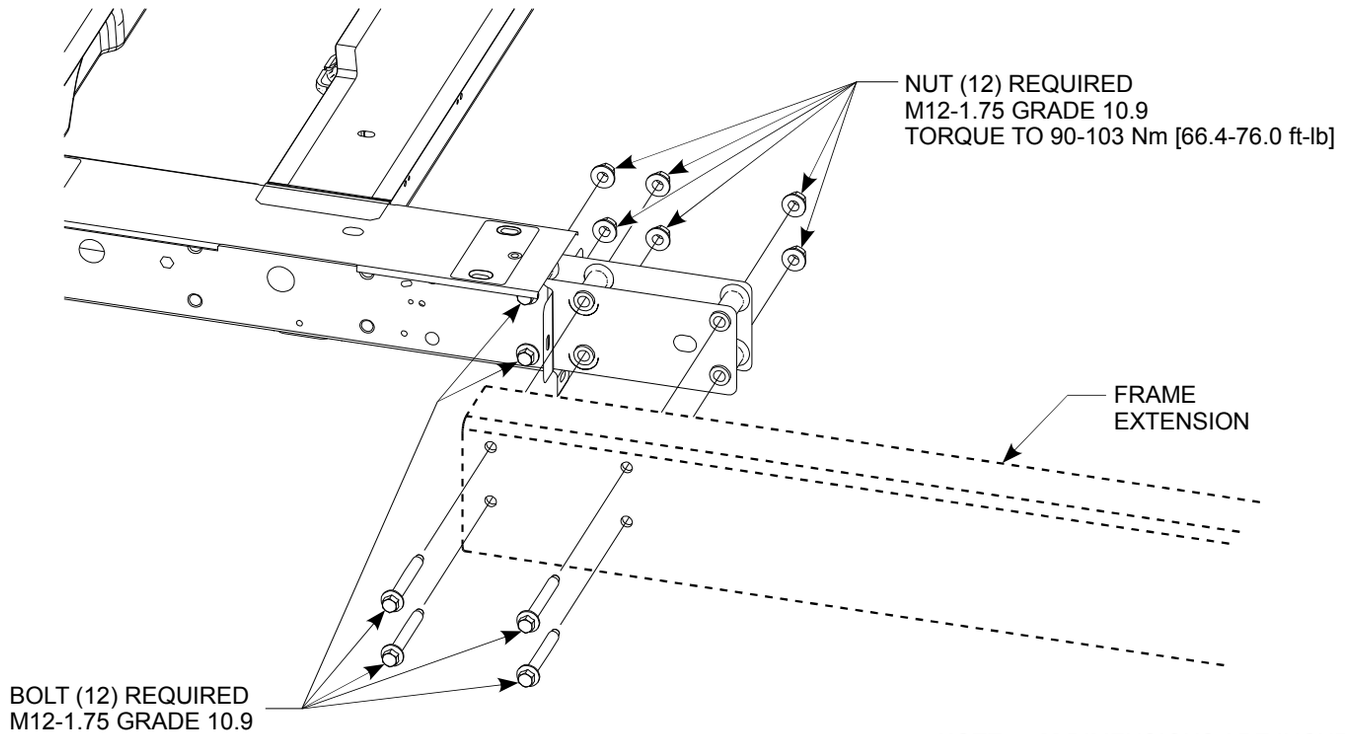


TRANSIT CHASSIS CAB & CUTAWAY SECOND UNIT BODY FRAME RAIL MOUNTING HOLES

(Cont'd next page)

SECOND UNIT BODY
TRANSIT (Cont'd)
REAR FRAME EXTENSION

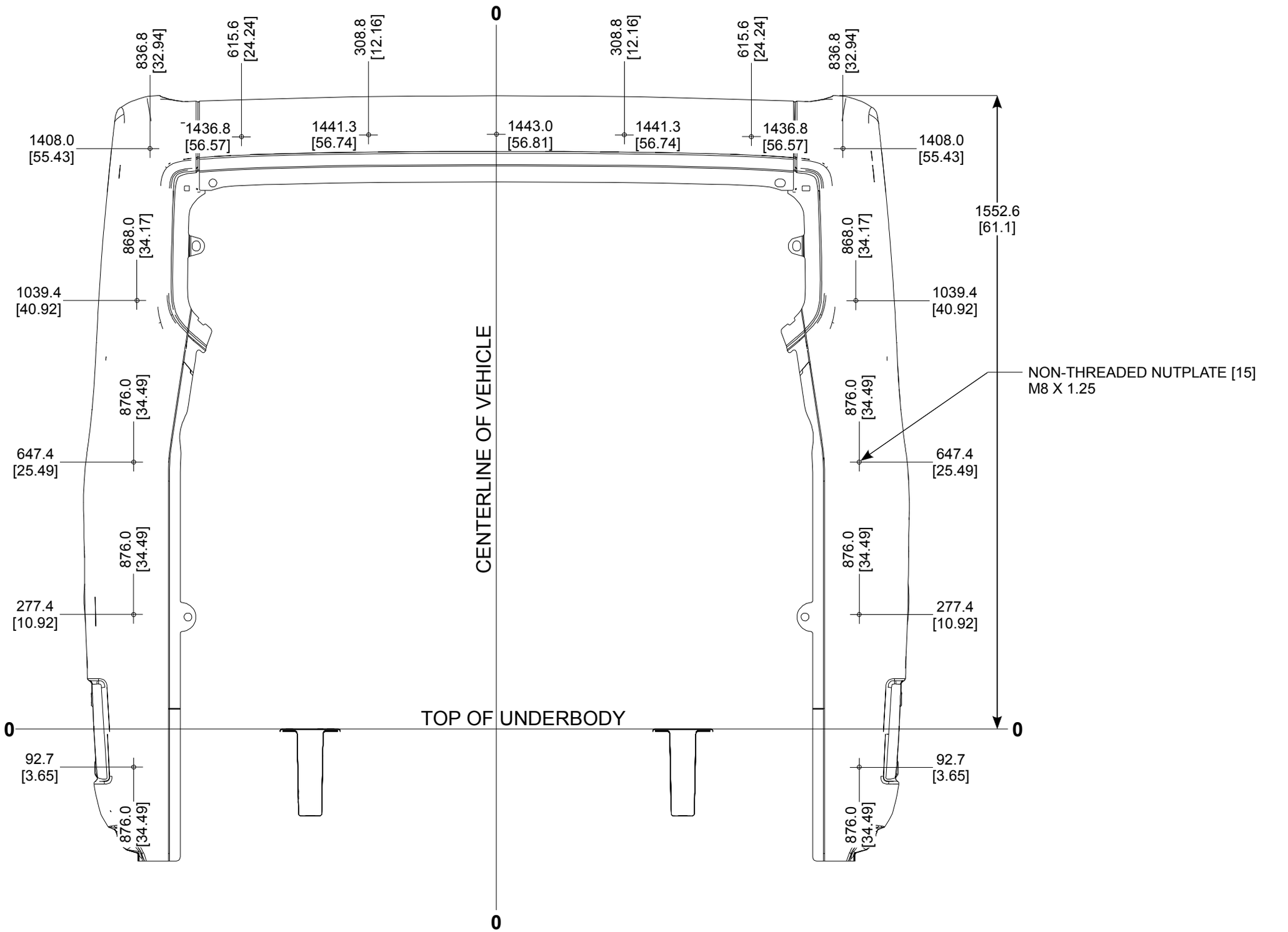




NOTE — [ ] DIMENSIONS ARE INCHES.

(Cont'd next page)

SECOND UNIT BODY
TRANSIT (Cont'd)
CUTAWAY BACK OF CAB MOUNTING HOLES



NOTE — [ ] DIMENSIONS ARE INCHES.